

# *EnergyIQ*

## **Action-oriented Benchmarking for Non-Residential Buildings**

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# Roadmap

- Why benchmark?
- What to benchmark?
- Some history of efforts (LBNL and beyond)
- EnergyIQ
  - ❑ Approach
  - ❑ Walkthrough
  - ❑ Technology transfer efforts
  - ❑ Drilldown documentation
  - ❑ Challenges

# Why benchmark energy?

- Establish baseline and track performance
- Inform and (later) validate design
- Identify best practices; set goals or standards
- Prioritize efforts
- Identify savings potential
- Educate; Inspire!

*Energy benchmarking is one part of a broader energy management process*



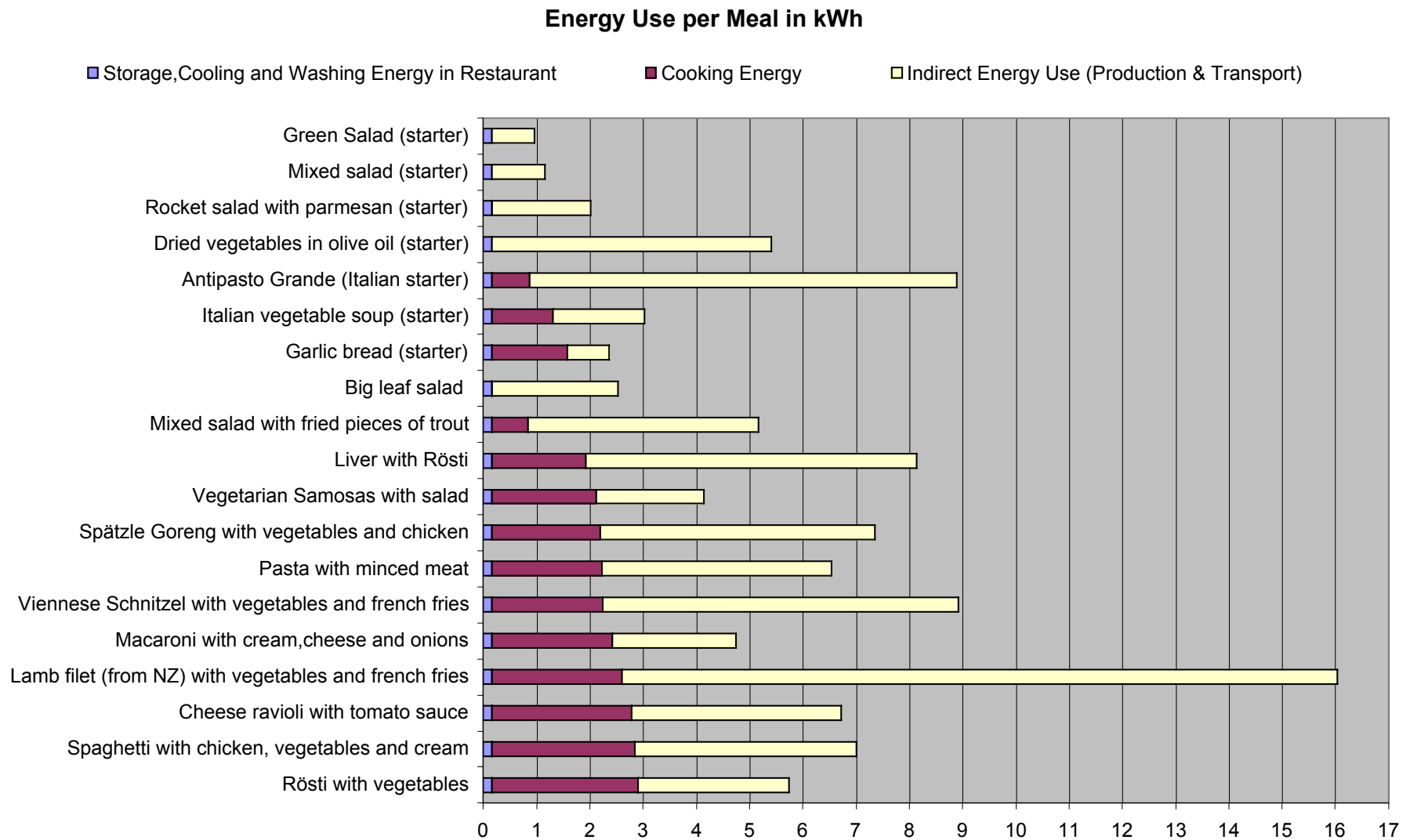
## What to benchmark?

“To define an energy efficiency indicator is not only a technical challenge, but also a pre-structuring of the subsequent policy choice.”

»Aebischer, 2003



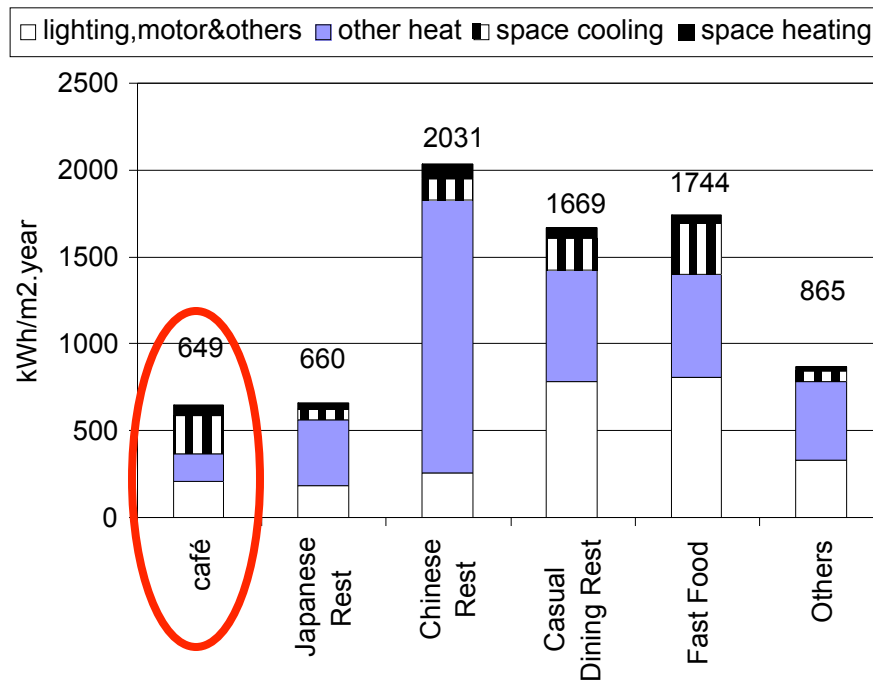
# Benchmarking as only the Swiss can do it



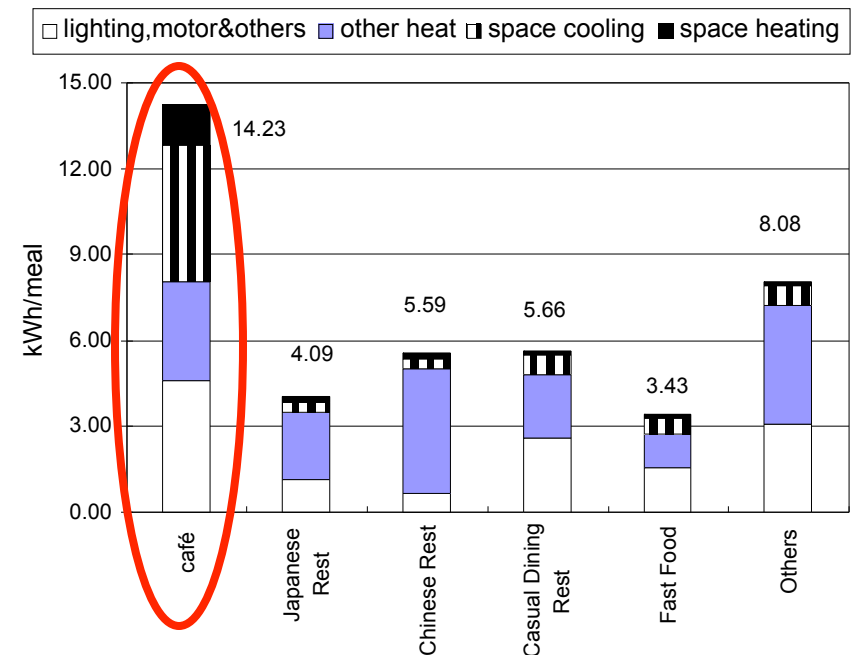
*Data for Switzerland. Source: Balmer and Hintermann, 2000*

# Choice of indicator is key

*Energy per unit floor area*



*Energy per meal*

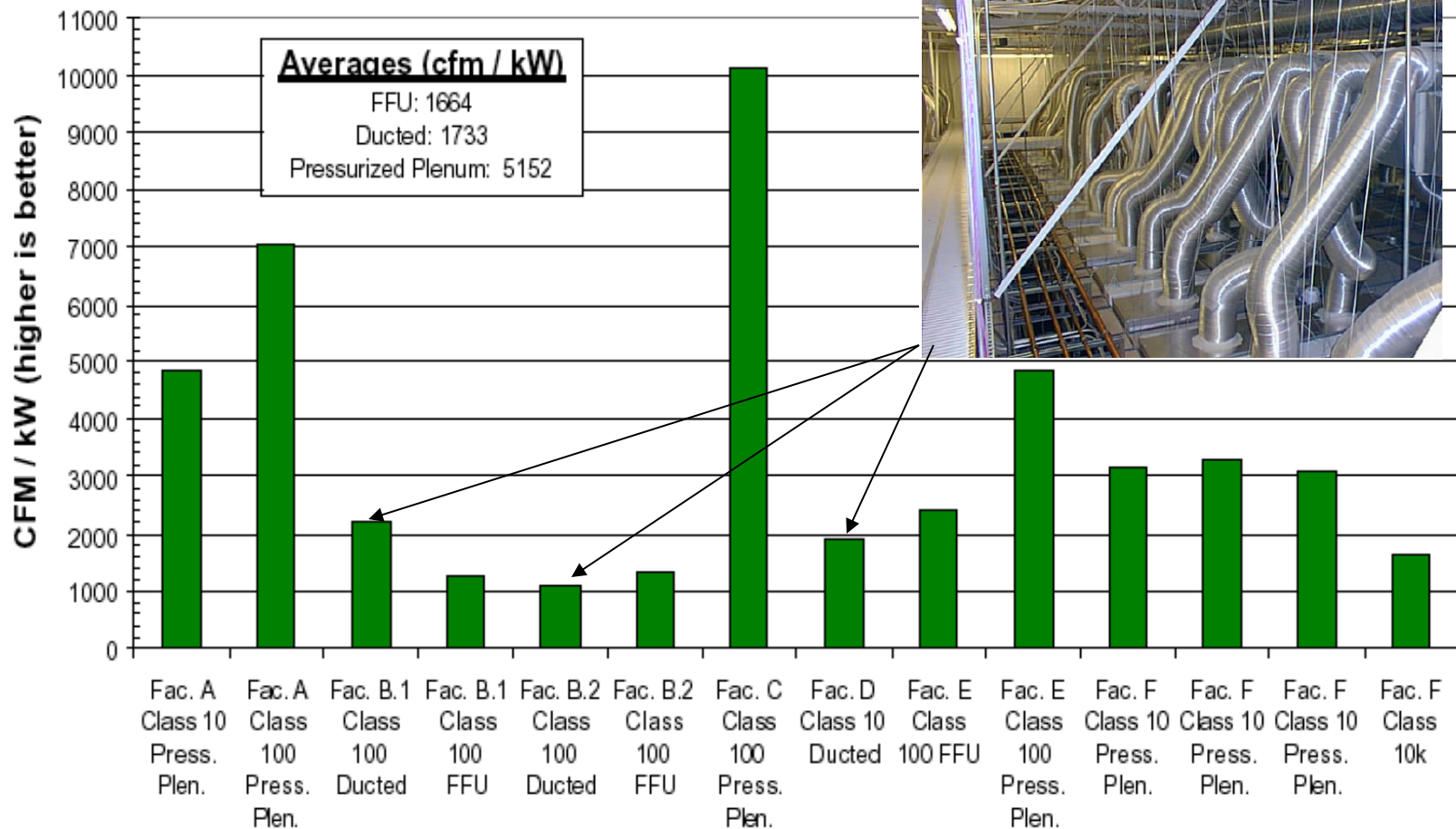


**Café ranks “best” by one benchmark and “worst” by the other**

Source: The Energy Data and Modeling Center, 2001

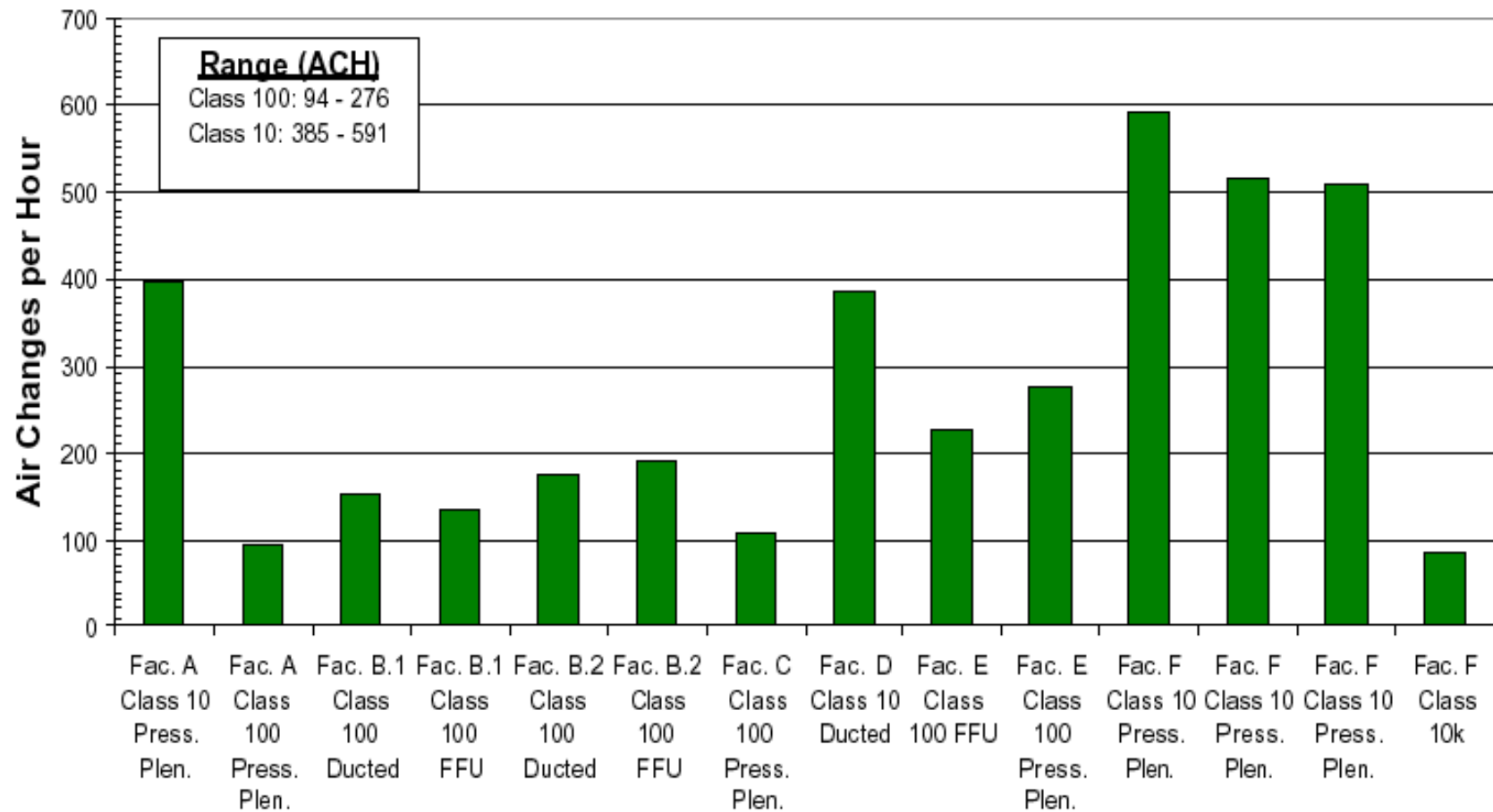
# Subsystem benchmarking

*Air movement CFM/kW (higher is better)*



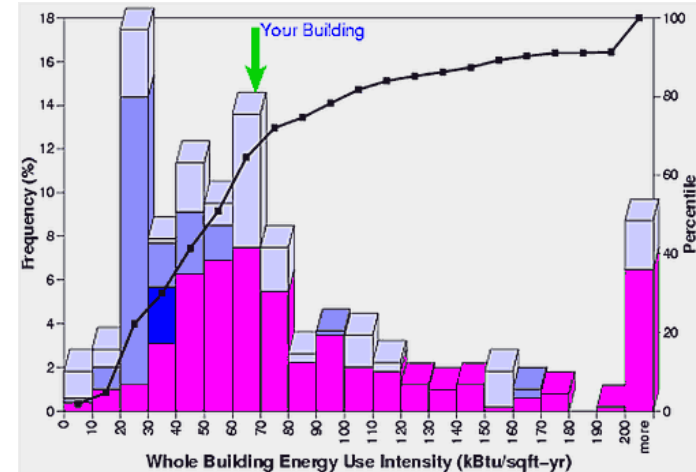
# “Service-level” benchmarking

*Air-changes per hour in Cleanrooms*



# Buildings energy benchmarking

- LBNL
  - ❑ Commercial bldgs:  
Cal-ARCH – early 2000s
  - ❑ High-tech facilities
  - ❑ EnergyIQ started in 2006
- EPA
  - ❑ Portfolio Manager
- Others
  - ❑ HERS
  - ❑ LEED
  - ❑ ...



# EnergyIQ – User-centered Development



# EnergyIQ team

- **Evan Mills** — Project lead — LBNL
- **Paul Mathew** — Analysis and Co-Leader — LBNL
- **Andrea Mercado** — Development Support, Testing, Customer Care — LBNL
- **Bob Ramirez** – iTron – Energy upgrade simulations
- **William Bordass Associates and the Usable Buildings Trust** — Advisors
- **Chris Ralph & Robert Garcia** — Programming and infrastructure — Bighead Technology (originally LBNL IT department ... but we won't talk about that in mixed company)
- **Kath Straub** — Usability and information design — Usability.org
- **Karen Fojas Lee** — Visual design — Nomad Chique
- **uTest** – Acceptance testing



# Action-oriented benchmarking extends whole-building benchmarking

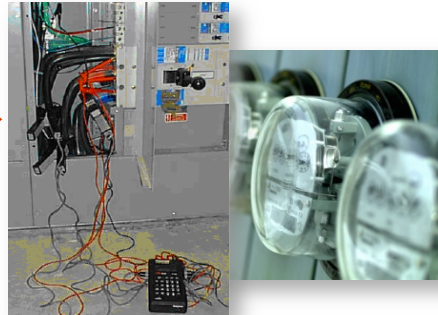
## Whole Building Energy Benchmarking



*Screen facilities for overall performance and potential*

*Minimal data requirements (utility bills, minimal information on building features)*

## Action-Oriented Energy Benchmarking



*Identifies and prioritizes specific opportunities or design options*

*More granularity: Uses system features and end-use data; may require additional data logging*

*Can inform RCx and Cx*

## Investment-Grade Energy Audit



*Estimates savings and cost for specific opportunities*

*Requires detailed data collection, simulation, cost estimation, financial analysis*

*Necessary for retrofits with capital investments*



# What is it?

- A low-effort bridge between whole-building benchmarks and investment-grade audits
  - ❑ Quick energy+cost+carbon analysis, with multiple metrics
  - ❑ Web-based (somewhat novel in 2006 when we began)
  - ❑ Not a simulation or audit tool...
- Customizable comparisons to customizable peer groups
  - ❑ Currently CEUS 2006 – California (N=2,800 bldgs); US – CBECS 2003 (N=5,215 bldgs); EIQ users (~800 bldgs)
- “Action-oriented”: Estimated savings of potential actions ... light-touch; not an investment-grade audit
- Licenseable APIs enable integration with other tools
  - ❑ e.g. benchmark analysis can complement EIS reports



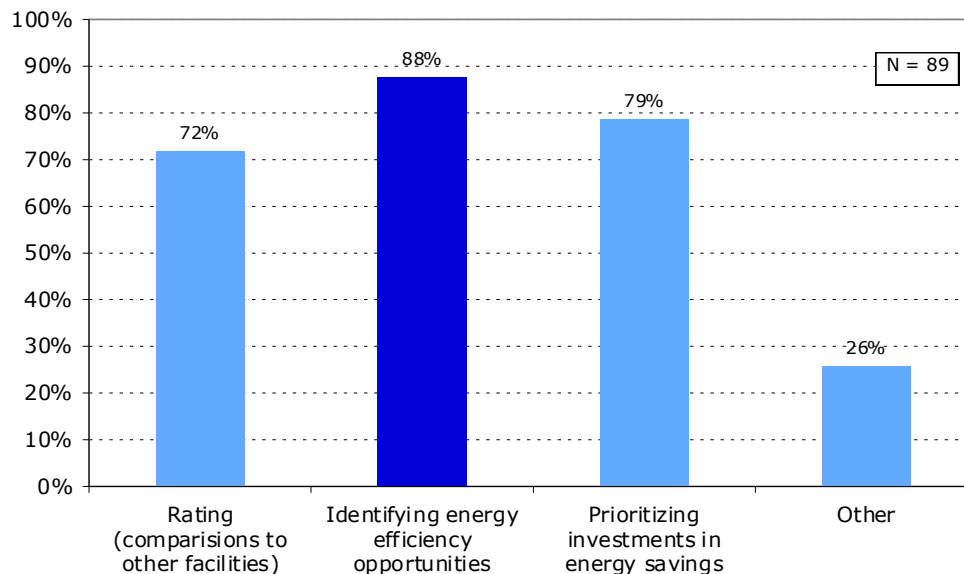
Developed by LBL for CEC - supports AB 1103 & 758



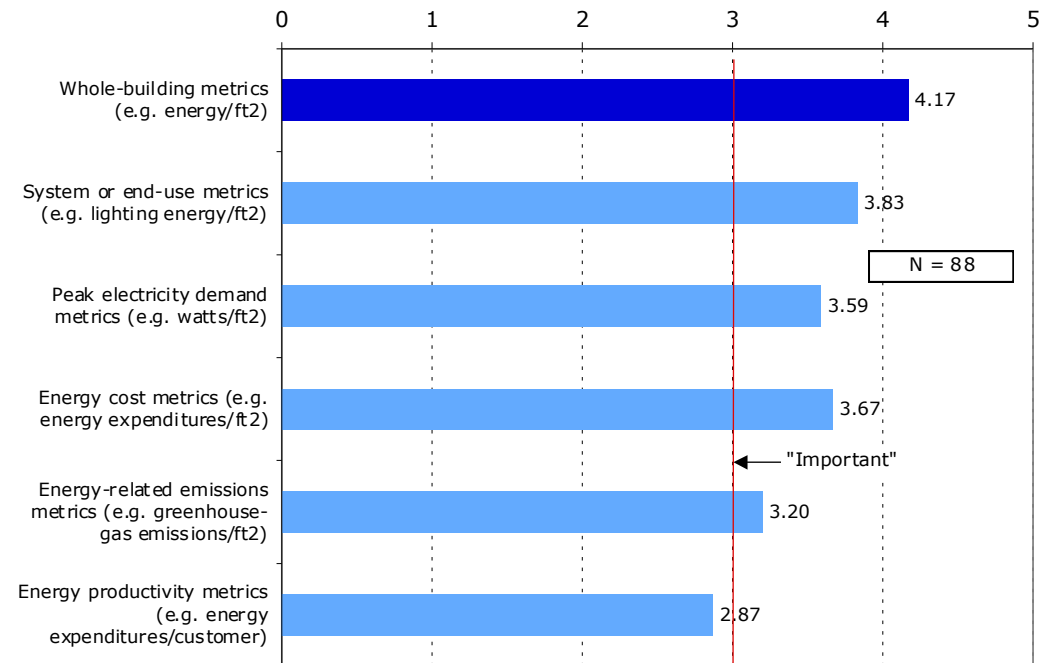
# Market Research

- Existing benchmarking practices
- Features desired in tool
- 101 respondents
  - Very good (20%) response rate; virtually all questions answered by each respondent
  - Respondents represent 554 million square feet of space directly influenced

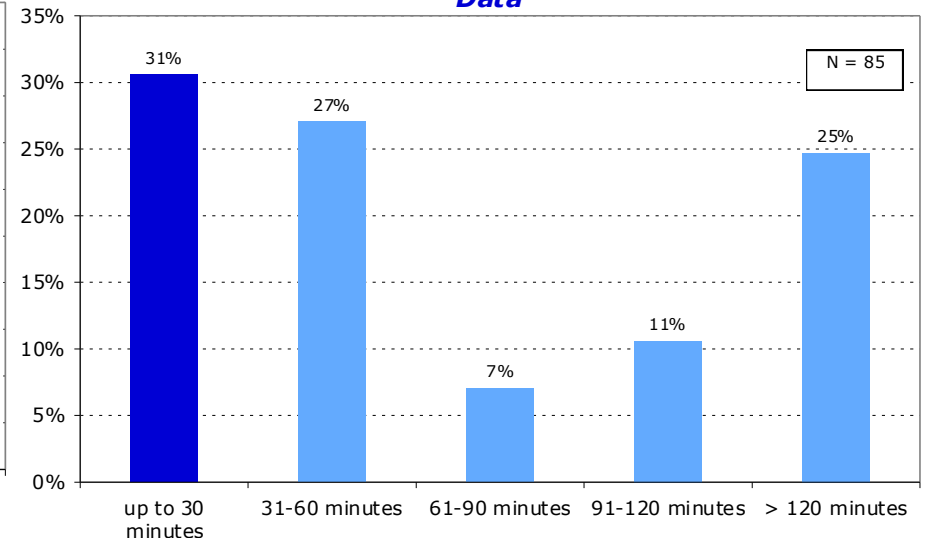
**LBNL Action-Oriented Benchmarking Survey**  
*Reasons for Energy Benchmarking*



**LBNL Benchmarking Survey**  
*Importance of Metrics*



**LBNL Action-Oriented Benchmarking Survey**  
*Willingness to Spend Time Gathering/Entering Data*



**Ta Dah!**

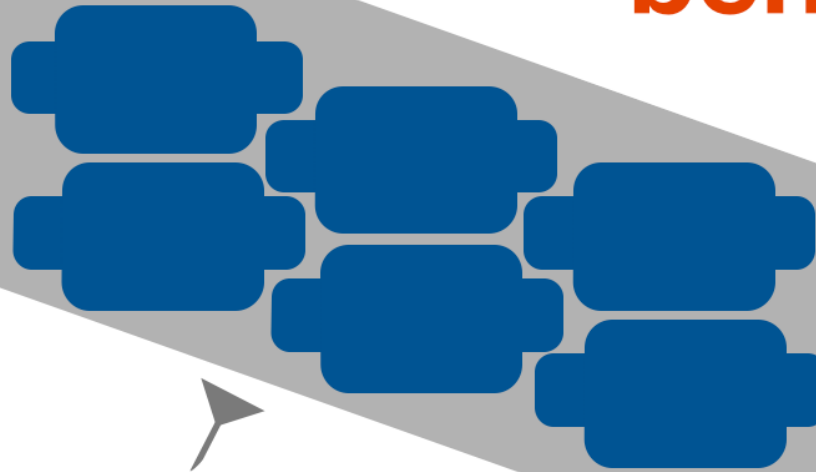
Energy*iq*



# Ecosystem

new  
behavior

barriers to  
commitment



persuasive  
interaction

existing  
belief +

Motivation

# Ecosystem

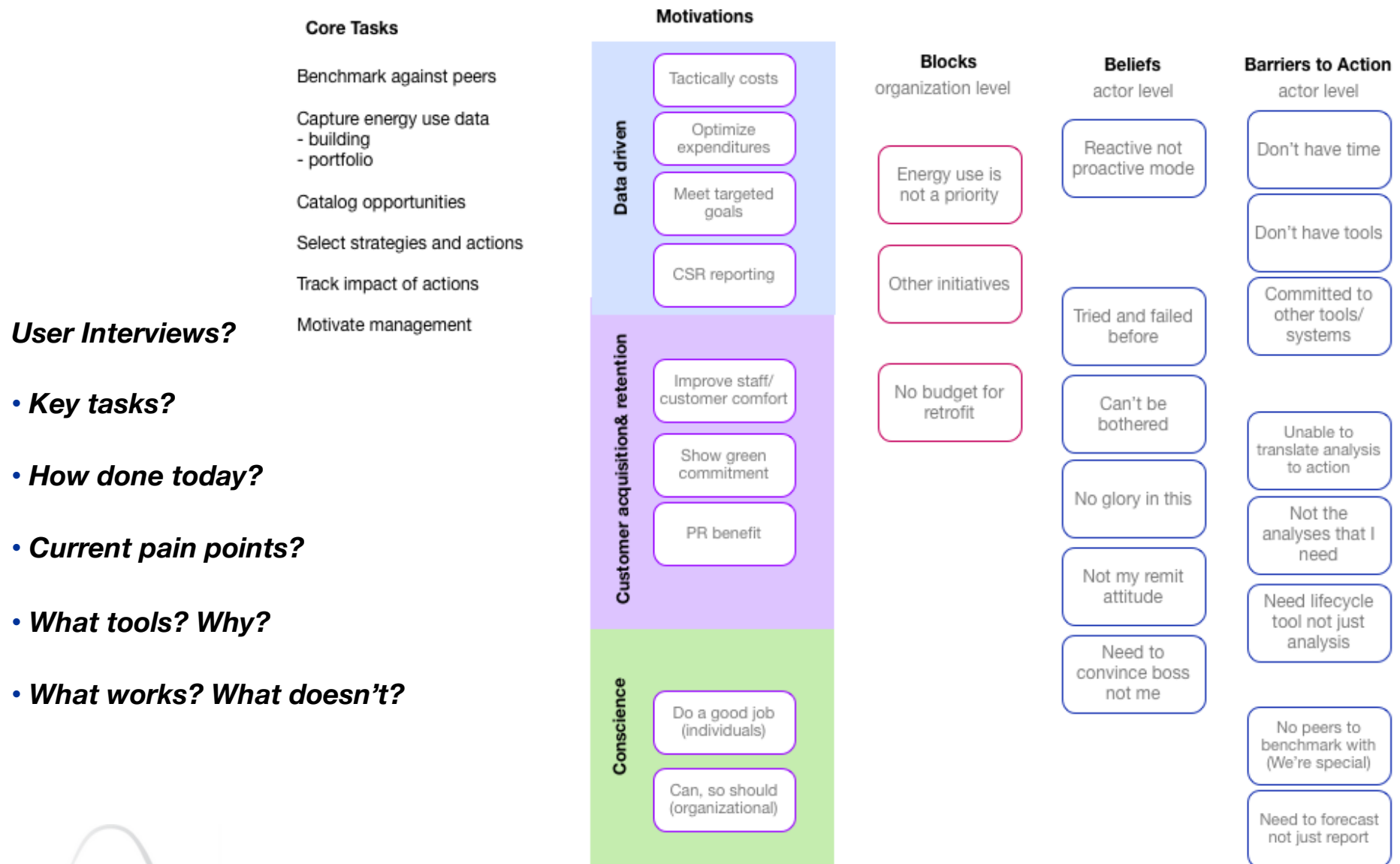
## barriers



## Motivation

<p>Reduce costs</p> <p>CSR reporting</p> <p>Meet targeted goals</p> <p>Optimize expenditures</p> <p><b>Data driven</b></p>	<p>PR benefit</p> <p>Show green commitment</p> <p>Staff/customer comfort</p> <p><b>Acquisition / Retention</b></p>	<p>Can, so should (organizational)</p> <p>Do a good job (individuals)</p> <p><b>Conscience</b></p>
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## User-centered design process: UNDERSTANDING USER NEEDS



### User Interviews?

- Key tasks?
- How done today?
- Current pain points?
- What tools? Why?
- What works? What doesn't?

## User-centered design process: User needs x best practice design

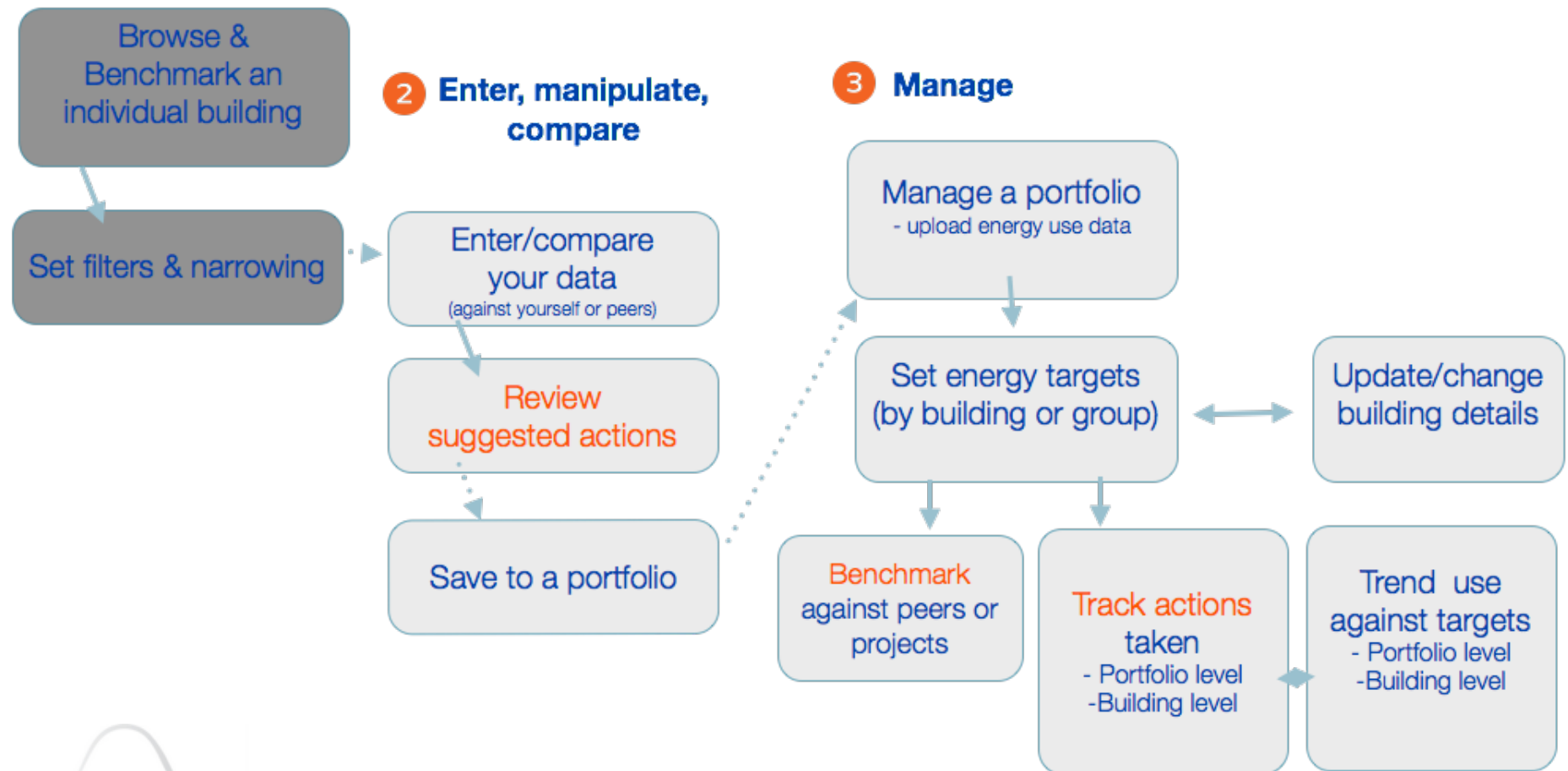
### Step 1: Task Mapping and Prioritization – Who will do what?

		Browsers	Building Managers	Building Owners	Architects	Real Estate Purchasers
Benchmark	Benchmark/Browse the patterns of a peer group	x	x	x	x	
	Benchmark my building in relation to a peer group (via just-in-time data entry)	x	x	x	?	<u>x</u>
		x	x	x		
	Create an account		x	x		
Enter building data	Create buildings in a portfolio (Describe characteristics)		x	x	<u>x</u>	<u>x</u>
	Enter energy data (in aggregate, by hand)		x			<u>x</u>
	Upload energy data (via Energy Portfolio)					?
	Set energy use targets		x	?		
Review Actions	Review recommended actions	?	x	x	x	x
Track portfolio	Track actions over time		x	x		
	Benchmark my buildings <u>w/</u> peer group				<u>x</u>	
	Save comparisons of interest		x			
	Configure my dashboard		x	x		
	Schedule/run reports - (includes Benchmarks)		x	x		
	Download data for further analysis		<u>x</u>	<u>x</u>	<u>x</u>	
	Print reports					
Learn	Learn about best practices	x	x	x	x	
About	Learn about the ElQ project					

## User-centered Design: User needs x best practice design

### Step2 - Task Analysis & Information Architecture - How will it flow?

#### 1 Filter data





### **Step 3- Wireframes – What does the interaction look like? What patterns emerge?**

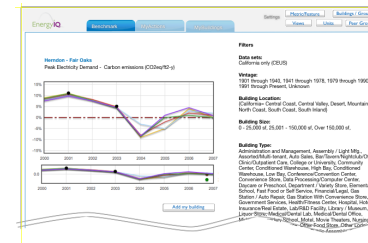
**EnergyIQ**

[Home](#) | 
 [New Group](#) | 
 [Lunch Phases](#) | 
 [Lunches](#) | 
 [Notes](#)

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Current Page Group: 33 Buildings

Metrics	Features	Lighting	Multi-Zone Air Handlers
Total Energy	Overview	Lighting	Equipment Type
Use Breakout	Road Inspection	Balast	Age
Total Fuel	Test Results	Control	Manufacturer
End Use Inventory	Glazing Data	Hours of Use	Tung Control
End Use Efficiency	Interior Shading		Emission rate
Fuel	Cooled Water		Operating Hours
Electricity	Chilled Water		Supply Fan Motor Eff.
	Heat Recovery		Return Air Motor Eff.
			Return Air Filter Efficiency
			Coil Cleaning Frequency
			Coil Cleaning Method
			Coil Cleaning Time
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			Coil Cleaning Method
			Coil Cleaning Time

[illegible]

**EnergyIQ**

**Building:** Austin - Twine Data **Rating:** New

**Rating Legend:** New (Green), Old (Red)

**Add energy**

**Substation:** Austin - Twine Data

**Load Energy Period:** April 2015

Energy Targets	Units	Target	Measure	Base Case	CO2	Other	Unit
Size Energy kWh/ft²	kWh/ft²	40	Size kWh/Meter	1.50	0.1	0.2	kWh/ft²
Size Energy kWh/ft²	kWh/ft²	40	Size kWh/Meter	1.50	0.1	0.2	kWh/ft²
Size Energy kWh/ft²	kWh/ft²	40	Size kWh/Meter	1.50	0.1	0.2	kWh/ft²
Size Energy kWh/ft²	kWh/ft²	40	Size kWh/Meter	1.50	0.1	0.2	kWh/ft²

**Add energy**

Energy Use	Type	Total	Lighting	Heating	Cooling	Ventilation	Process	Range	Unspecified
Size kWh/Meter	Electricity	1,200,000 kWh	300,000	0	600,000	250,000	150,000	0	0
Size kWh/Meter	Electricity	100,000 kWh	30,000	0	0	30,000	0	0	40,000
Size kWh/Meter	Natural Gas	5000 MCF	0	4,000	0	0	0	0	1,000



The screenshot shows the EnergyIQ website. At the top, there is a navigation bar with the EnergyIQ logo, a search bar, and links for 'Products', 'About Us', 'Contact Us', and 'Sign Up'. Below the navigation bar, there is a section titled 'Features' with a sub-header 'Features - Service Data'. The main content area displays a table with the following columns: #Features, Name, Fuel Type, Control Type, Hours, Monitoring type, Daylighting, Initial date, and Update. The table contains three rows of data:

#Features	Name	Fuel Type	Control Type	Hours	Monitoring type	Daylighting	Initial date	Update
1100	F10	Magnetic	Manual	8760	Wired/wireless	None	9/13/2008	Update
6000	Control Panel	Electronic	Touchscreen	30	Wired/wireless	None	9/13/2008	Update

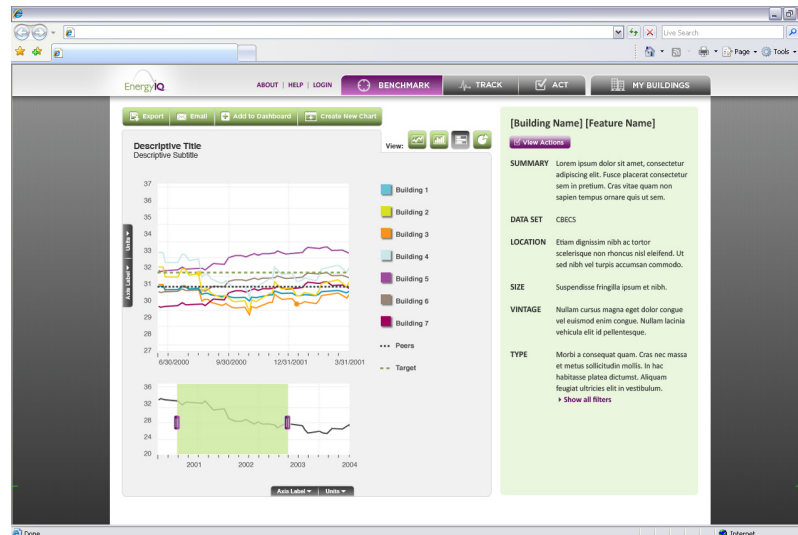
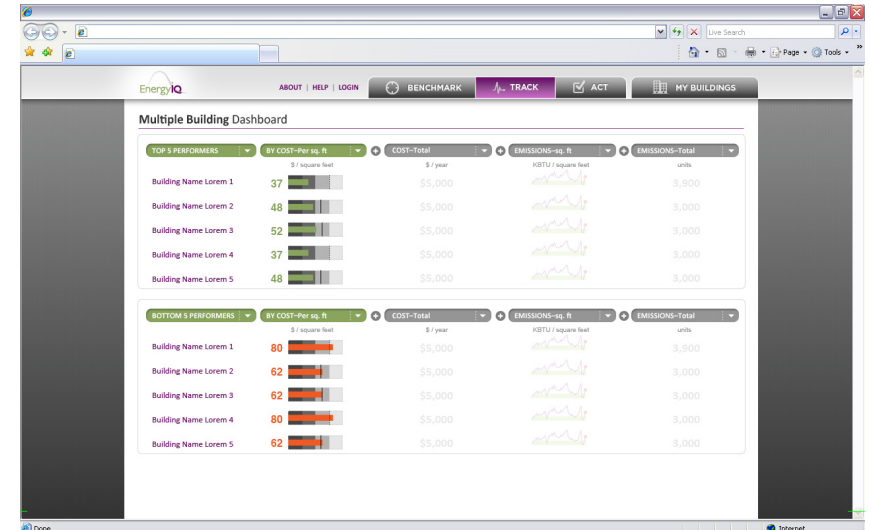
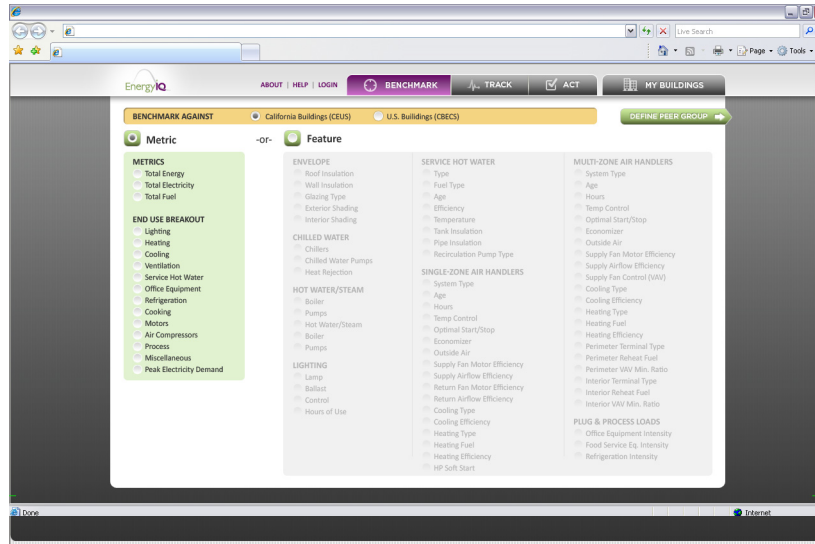
Below the table, there is a section titled 'Be Monitoring' with a sub-header 'Be Monitoring - Service Data'. The main content area displays a table with the following columns: #Features, Name, Fuel Type, Control Type, Hours, Monitoring type, Daylighting, Initial date, and Update. The table contains three rows of data:

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6000	Control Panel	Electronic	Touchscreen	30	Wired/wireless	None	9/13/2008	Update

# User-centered redesign: VISUAL DESIGN

## Color and layout attributes

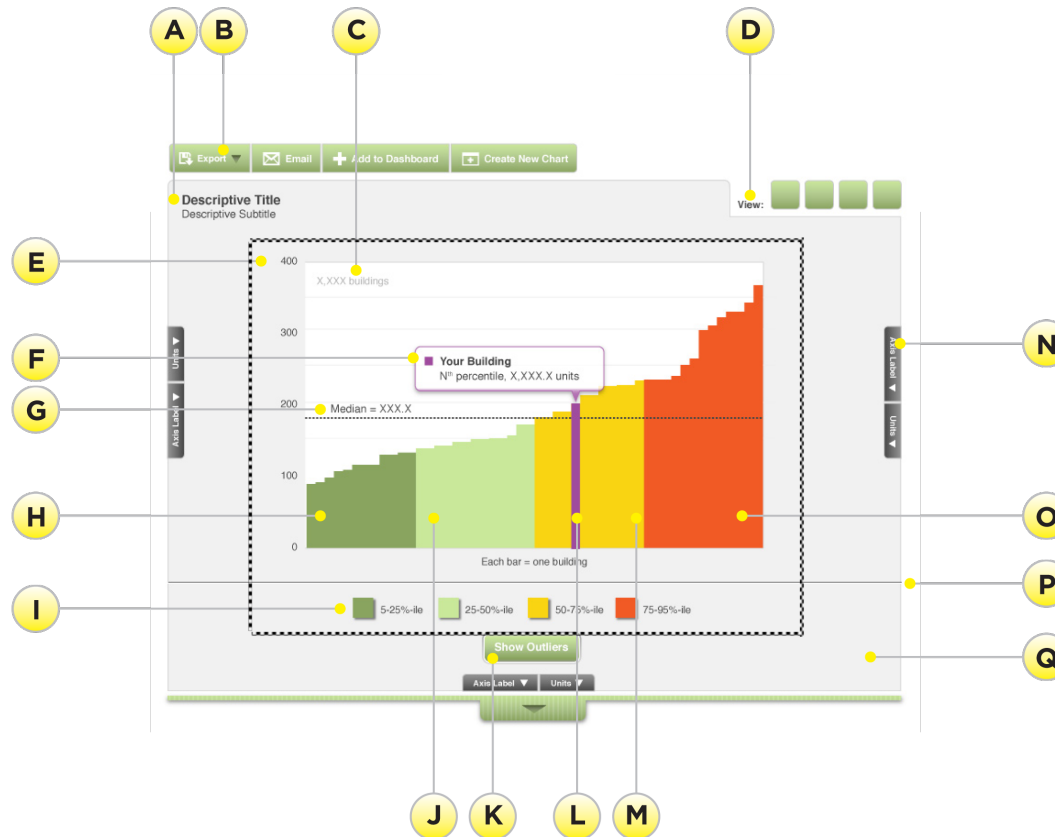
## Draw user attention to key interactions and options



# Formal Style Guide

## Chart 1: Ranked Bar Chart with Container Frame

- A. Descriptive Title = Helvetica, Bold, 14px, #464646  
Offset = 16px from top and left of inside of frame  
Descriptive Subtitle = Helvetica, Normal, 14px, #464646  
Line Height = 14px
- B. Utility Button Labels = Helvetica, Bold, 10px, #FFFFFF
- C. Dataset Size = Helvetica, Normal, 11px, #B3B3B3  
Inset 12px from left and top of frame
- D. View = Helvetica, Bold, 11px, #464646
- E. Axis Values/Labels = Helvetica, Normal, 11px, #464646  
Offset = 10px from edge of frame
- F. Callout Bubble:  
Label = Helvetica, Bold, 12px, #464646  
Bubble Outline = #9F4B9E, 1 px stroke, 6px corner radius, dropshadow  
Label Units = Helvetica, Normal, 11 px, #464646
- G. Median line = Helvetica, Normal, 12px, #464646; 2px dashed line with 2px gaps
- H. 5-25%-ile = #89A45E
- I. Legend Labels = Helvetica, Normal, 11 px, #464646;  
Each legend swatch = 22 x 22 px with drop shadow
- J. 25-50%-ile = #CAE89A



- K. Button Label = Helvetica, Bold, 12px, #FFFFFF, Use graphic for button
- L. Your Building Bar = #9F4B9E
- M. 50-75%-ile = #F8D413
- N. Axis Label/Units Dropdown Menu = Helvetica, Bold, 9px, #FFFFFF
- O. 75-95%-ile = #F15A24
- P. Legend Separator = 1px stroke, #FFFFFF  
Dropshadow = 50% Black, X-offset, = 1px, Y-offset = -1px, Blur = 0px
- Q. Background Fill = #EFEFEF  
Outline = 1px stroke, #D7D7D7

### Color Palette Used for this Chart:

	#464646
	#9F4B9E
	#89A45E
	#CAE89A
	#F8D413
	#F15A24
	#D7D7D7
	#EFEFEF

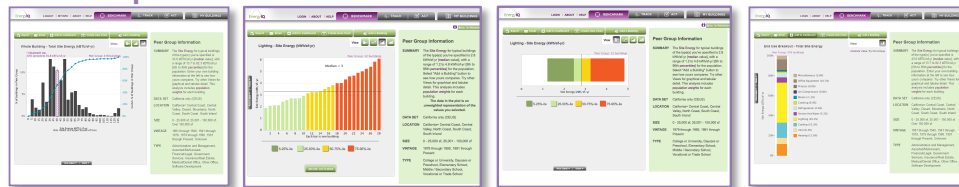
# Walkthrough



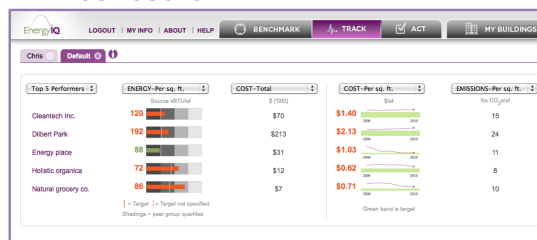
# Action-Oriented Benchmarking with EnergyIQ

- ✓ **Rapidly benchmarks utility bills against user-defined peer groups => low-cost opportunity assessment**
- ✓ **Non-residential buildings: Peers drawn from CEC's CEUS for California and DOE's CBECs for rest of US**
- ✓ **Many choices of metrics and data visualizations**
- ✓ **Can import data from EPA's Portfolio Manager**

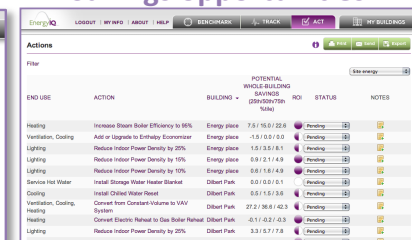
## ✓ Multiple data visualizations



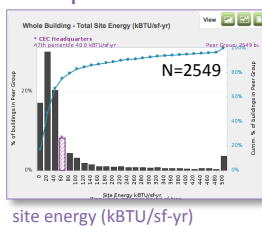
## ✓ Dashboard



## ✓ Savings opportunities



## Compared to ...all California buildings

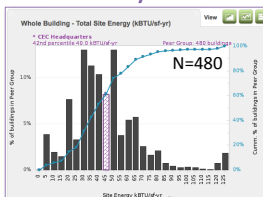


<http://energyiq.lbl.gov>



Contact: [emills@lbl.gov](mailto:emills@lbl.gov)

## ...+ only offices



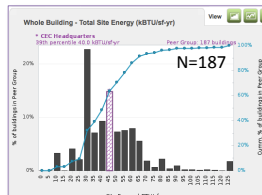
## Market Uptake:

- ✓ 900 registered users
- ✓ 650 buildings benchmarked, representing 88 million sq. ft. floor area
- ✓ 14,000 unique visitors to website as of mid-2013

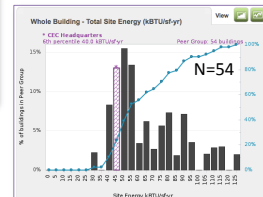
## Example: CEC Headquarters

*A building that is average when looked at coarsely, but among the best-in-class when benchmarked using progressively appropriate peer groups*

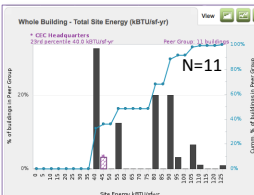
## ... + 1979-1990 vintage



## ... + 25-150k sf size range

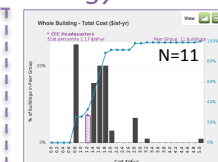


## ... + Central Valley

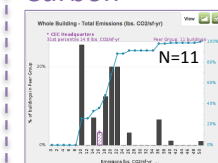


## Other metrics →

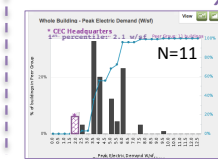
## Energy cost



## Carbon



## Peak electricity





ACTION-ORIENTED ENERGY BENCHMARKING

## What's your building's EnergyIQ?

EnergyIQ is an action-oriented benchmarking tool for non-residential buildings. Energy managers, building owners, architects and engineers use it to:

- ✓ Identify energy efficiency opportunities
- ✓ Save money
- ✓ Reduce carbon emissions

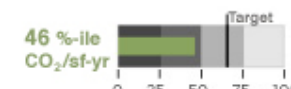
**BENCHMARK A BUILDING** ➔

### BENCHMARK

■ Herndon-Birch Run: 60th percentile, \$1.35/sf-yr



### TRACK



### ✓ ACT

End Use	Action	Building	Possible Savings	ROI
<input type="checkbox"/> Lighting	L2-Installed Occupancy Controls	Herndon2	\$3,700/yr	🟢
<input type="checkbox"/> Chilled Water	CW-2 High-Efficiency HVAC pumps	Baltimore-West Park	\$7,600	🟢



California Environmental Protection Agency  
**Air Resources Board**

EnergyIQ and the **EnergyIQ API** were developed by the Lawrence Berkeley National Laboratory with funding from PIER and the California Environmental Protection Agency.

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# Select Metrics or Characteristics

- Choose population to benchmark against (California; Other US)
- Benchmark energy or characteristics
- Choose metric, and normalization units (e.g. floor area, employees, hotel beds)
  - ❑ Whole building
  - ❑ Fuel
  - ❑ End Uses

The screenshot shows the EnergyIQ Benchmarking tool interface. At the top, there is a navigation bar with links for LOGIN, ABOUT, HELP, BENCHMARK, TRACK, ACT, and MY BUILDINGS. Below this, a section titled 'BENCHMARK AGAINST' allows users to select a benchmarking population: California Buildings (CEUS) or U.S. Buildings (CBECS). There are also checkboxes for 'CEUS or CBECS Dataset', 'EnergyIQ User Dataset', and 'My Portfolio'. A 'DEFINE PEER GROUP' button is on the right. The main content area is divided into two columns: 'Energy' and 'Features'. The 'Energy' column has a 'Metrics' section with a tree view showing 'WHOLE-BUILDING' (Total Energy, Total Electricity, Total Fuel, Peak Electricity Demand), 'END USE BREAKOUT' (Total, Electricity, Fuel), and 'END USE' (Lighting, Heating, Cooling, Ventilation, Service Hot Water, Office Equipment, Refrigeration, Cooking, Motors, Air Compressors, Process, Miscellaneous). A 'Normalize' button is at the bottom of the 'Energy' column. The 'Features' column contains several sections of characteristics: LIGHTING (Lamp, Ballast, Controls, Hours of Use), CHILLED WATER (Type, Fuel Type, Heat Rejection Type, Average Age, Efficiency-Full Load, Efficiency-IPLV, Efficiency-COP, Chilled Water Reset, VSD Compressor, Cooling Lockout Temp, Water Side Economizer), CHILLED WATER PUMPS (Average Age, Motor Type, Motor Efficiency), HEAT REJECTION (Type), SERVICE HOT WATER (Type, Fuel Type, Age, Efficiency (Energy Factor, Thermal Efficiency, AFUE, COP, Temperature, External Insulation Jacket, Pipe Insulation, Recirculation Pump Type)), SINGLE ZONE AIR HANDLERS (System Type, Age, Temp Control, Optimal Start/Stop, Economizer, Outside Air %, Supply Fan Motor Efficiency, Supply Airflow Efficiency, Return Fan Motor Efficiency, Return Airflow Efficiency, Return Fan Control (VAV), Cooling Type), COOLING EFFICIENCY (EER, Heating Type, Heating Fuel), HEATING EFFICIENCY (AFUE, Thermal  $\eta$ , Perimeter Terminal Type, Perimeter Reheat Fuel, Perimeter VAV Min. Ratio, Interior Terminal Type), and MULTI-ZONE AIR HANDLERS (System Type, Age, Temp Control, Optimal Start/Stop, Economizer Type, Outside Air %, Supply Fan Motor Efficiency, Supply Airflow Efficiency, Supply Fan Control (VAV), Return Fan Motor Efficiency, Return Airflow Efficiency, Return Fan Control (VAV), Cooling Type).

# Define Peer Group

- Filter on
  - ☐ floor area
  - ☐ hours of operation
  - ☐ vintage
  - ☐ location
  - ☐ certifications
- Choose any combination of 62 building types

EnergyIQ LOGIN | ABOUT | HELP BENCHMARK TRACK ACT MY BUILDINGS

## Define Peer Group

[Back to Metrics & Features](#) [DRAW CHART](#)

Select floor area, operations, vintage, characteristics, and location.

Then, select your building types.

☐ ALL

☒ OFFICE

- ☒ Administration and Management
- ☒ Financial/Legal
- ☒ Insurance/Real Estate
- ☒ Government Services
- ☒ Software Development
- ☒ Medical/Dental Office
- ☒ Assorted/Multi-tenant
- ☒ Other Office

☐ DATA CENTER

☐ LABORATORY

☐ RESTAURANT

- ☐ Fast Food or Self Service
- ☐ Specialty/Novelty food service
- ☐ Table Service
- ☐ BAR/Tavern/Nightclub/Other
- ☐ Other Food Service

☐ FOOD STORE

- ☐ Supermarkets
- ☐ Small General Grocery
- ☐ Specialty Ethnic Grocery
- ☐ Convenience Store
- ☐ Liquor Store
- ☐ Other Food Store

☐ RETAIL

- ☐ Department/Variety Store
- ☐ Retail Warehouse/Clubs
- ☐ Shop in Enclosed Mall
- ☐ Shop in Strip Mall
- ☐ Auto Sales
- ☐ Other Retail Store

☐ WAREHOUSE (REFRIGERATED)

☐ WAREHOUSE (NON-REFRIGERATED)

- ☐ Unconditioned Warehouse High Bay
- ☐ Unconditioned Warehouse Low Bay
- ☐ Conditioned Warehouse High Bay
- ☐ Conditioned Warehouse Low Bay

☐ HEALTHCARE

- ☐ Hospital
- ☐ Nursing Home
- ☐ Clinic/Outpatient Care
- ☐ Medical/Dental Lab

☐ SCHOOL

- ☐ Daytime or Preschool
- ☐ Elementary School
- ☐ Middle/Secondary School

☐ COLLEGE

- ☐ College or University
- ☐ Vocational or Trade School

☐ LODGING

- ☐ Hotel
- ☐ Motel
- ☐ Resort
- ☐ Other Lodging

☒ PUBLIC ASSEMBLY

- ☒ Library/Museum
- ☒ Conference/Convention Center
- ☒ Religious Assembly (Worship only)
- ☒ Religious Assembly (Mixed use)
- ☒ Health/Fitness Center
- ☒ Theater/Performing Arts
- ☒ Community Center
- ☒ Other Recreation/Public Assembly

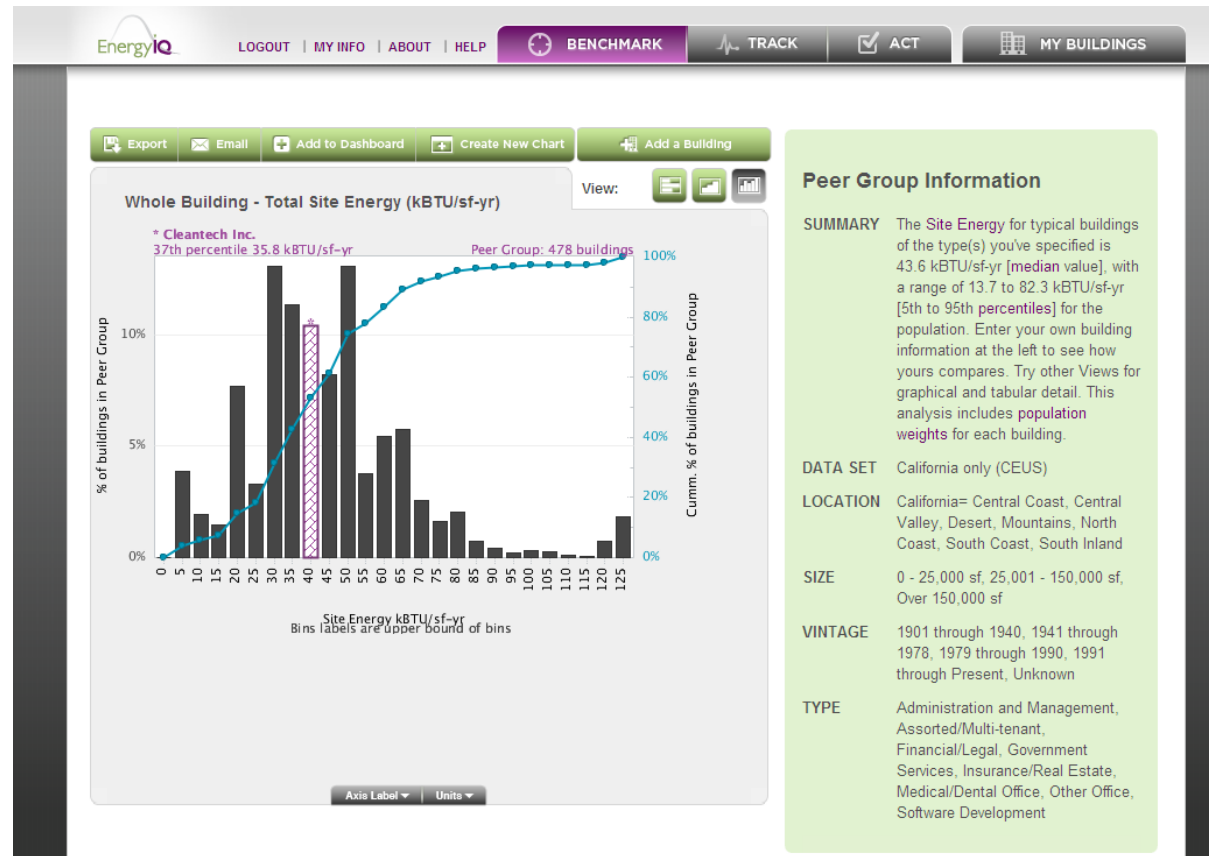
☐ MISCELLANEOUS

- ☐ Gas Station
- ☐ Gas with Convenience Store
- ☐ Repair (Non-Auto)
- ☐ Other Service Shop
- ☐ Assembly / Light Mfg.
- ☐ Police / Fire Stations
- ☐ Post Office
- ☐ Other Unlisted Type

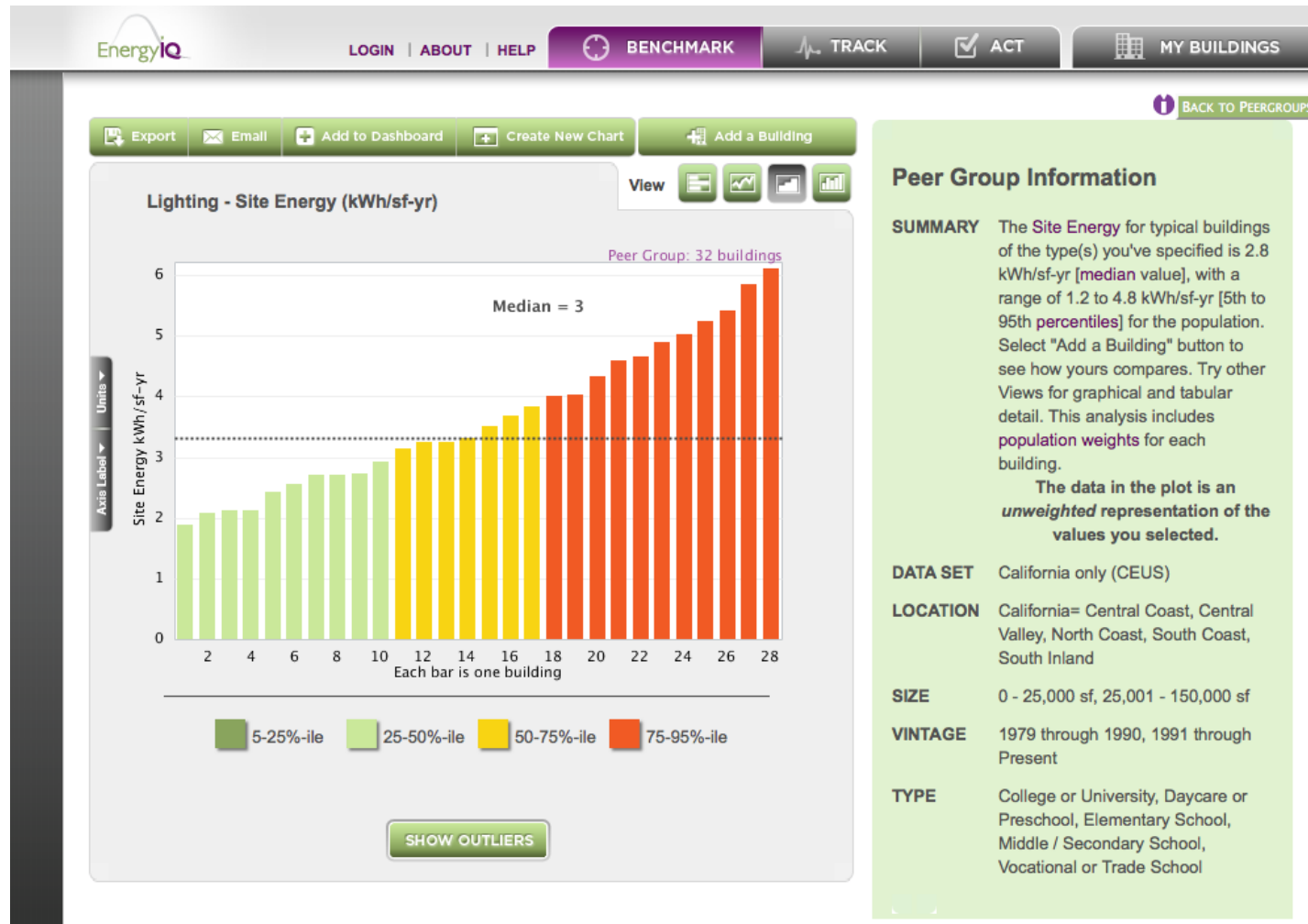


# Benchmark: Frequency Distribution

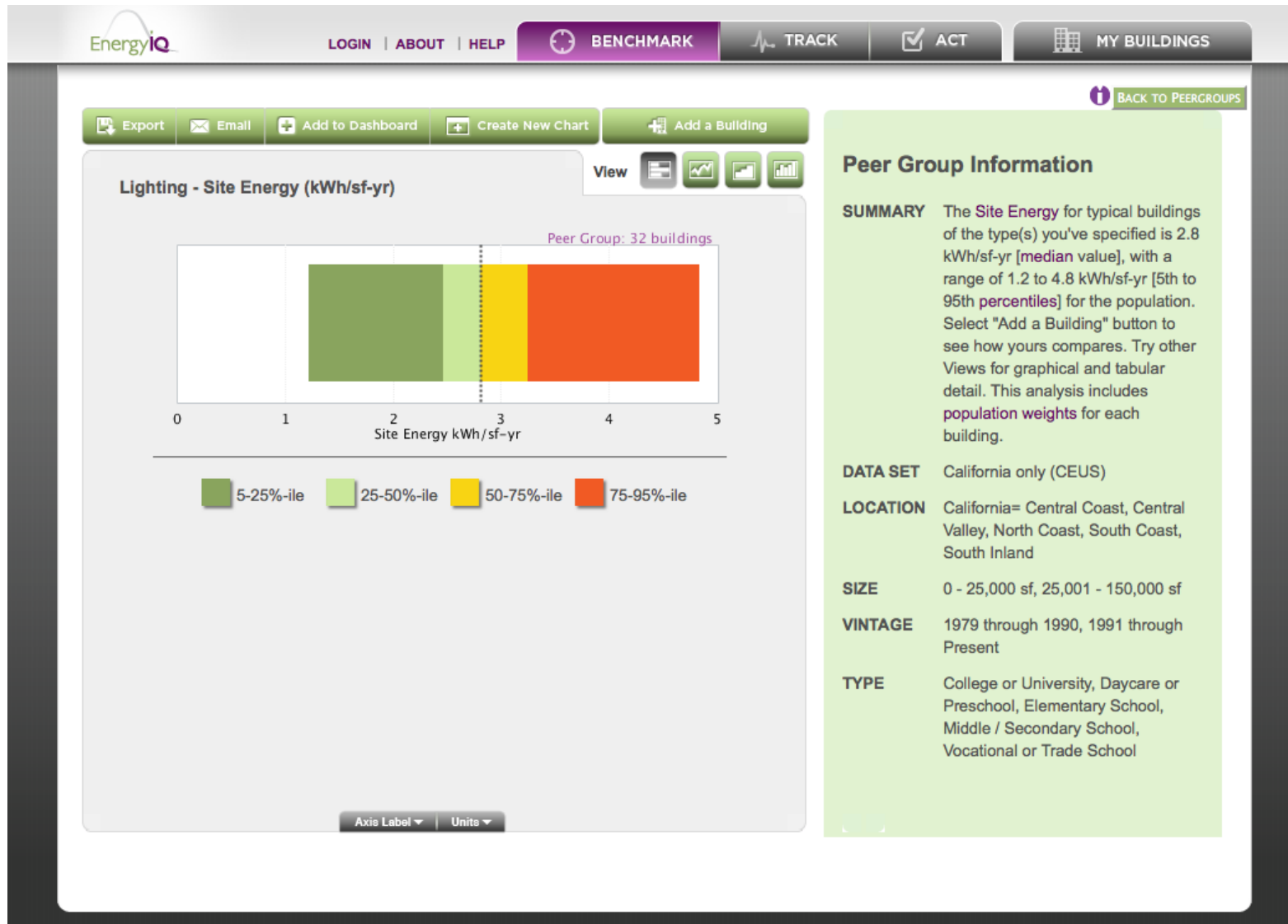
- Choose among several benchmarking views...
  - ❑ Cross-sectional
  - ❑ Longitudinal (if multi-year data is entered)
- Add your building



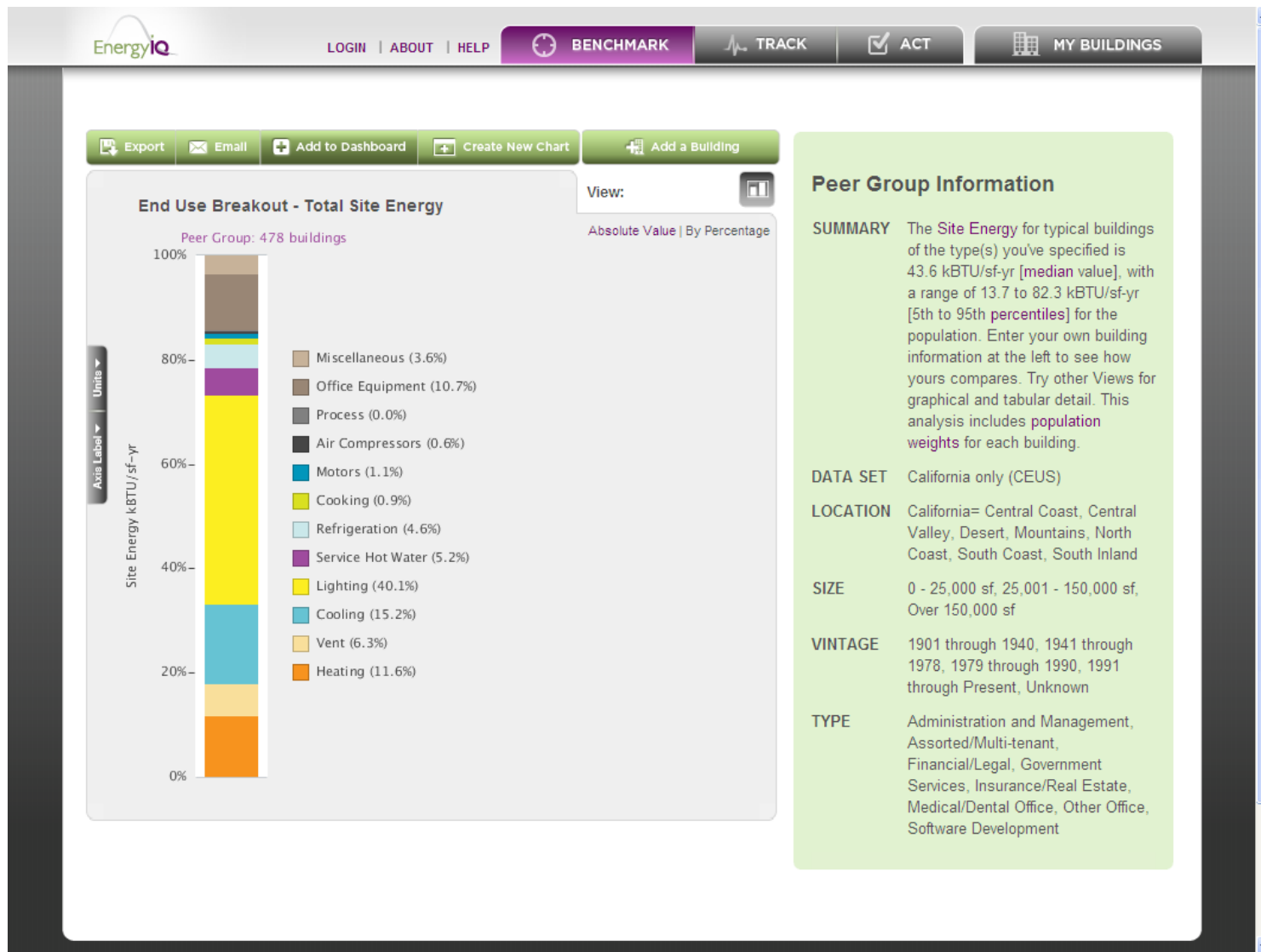
# Benchmark: Ranked Bar View



# Benchmark: Range Bar View

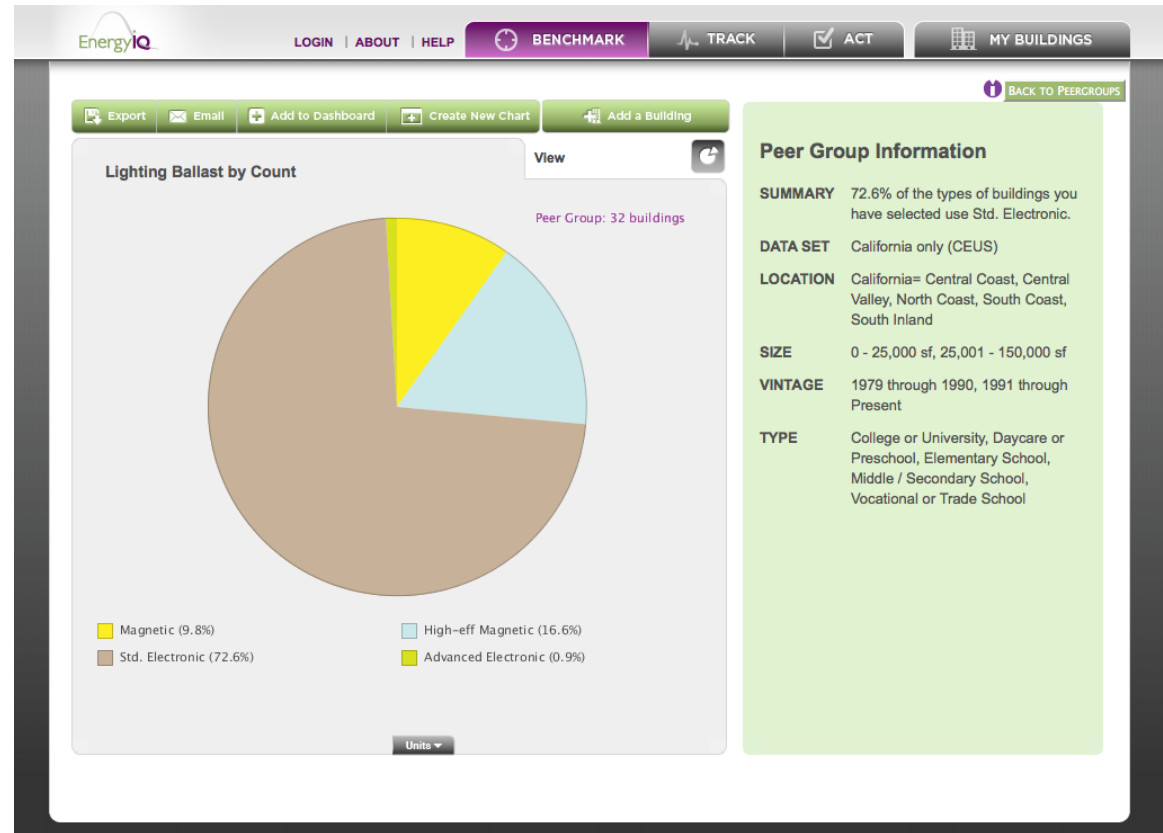


# Benchmark: End-use Breakout View

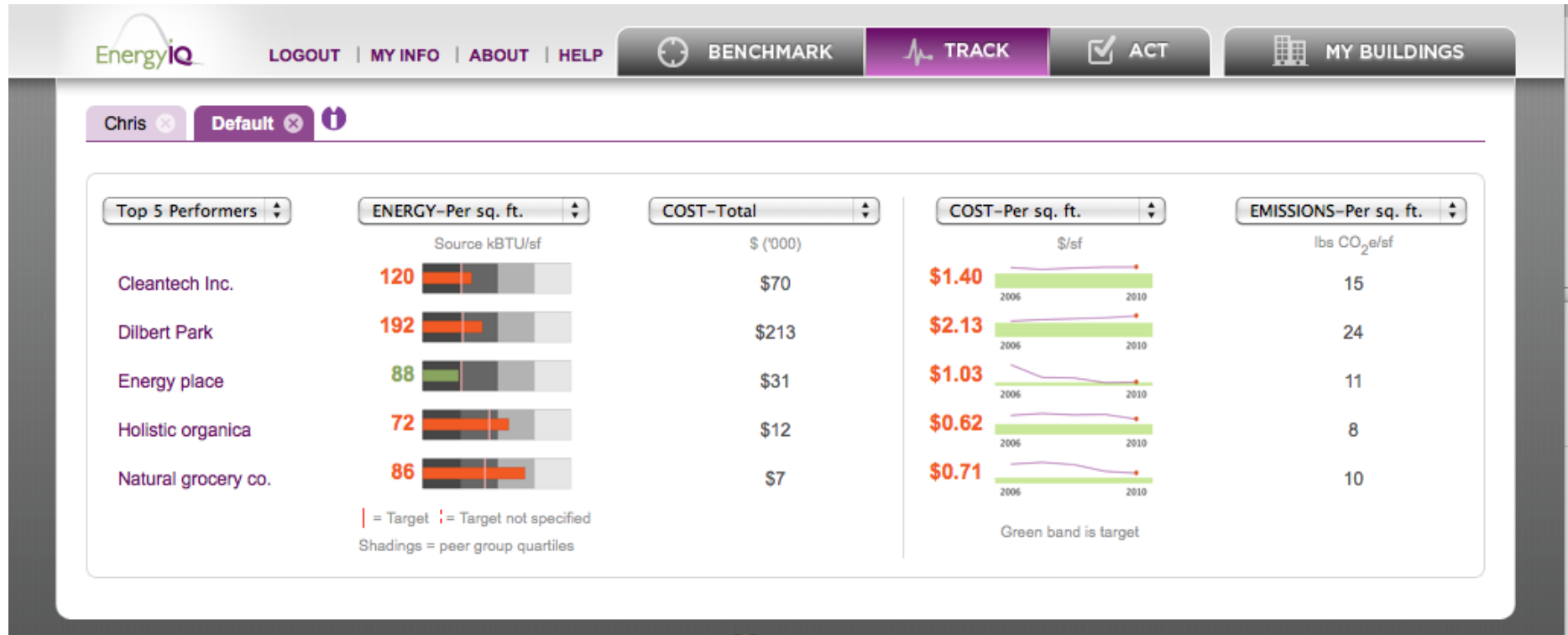


# Benchmark: Building Characteristics

- When choosing “Features” instead of energy benchmarks, an analysis is shown of the frequency of types of features (lighting, hvac, envelope, etc.) in the user-selected peer-group



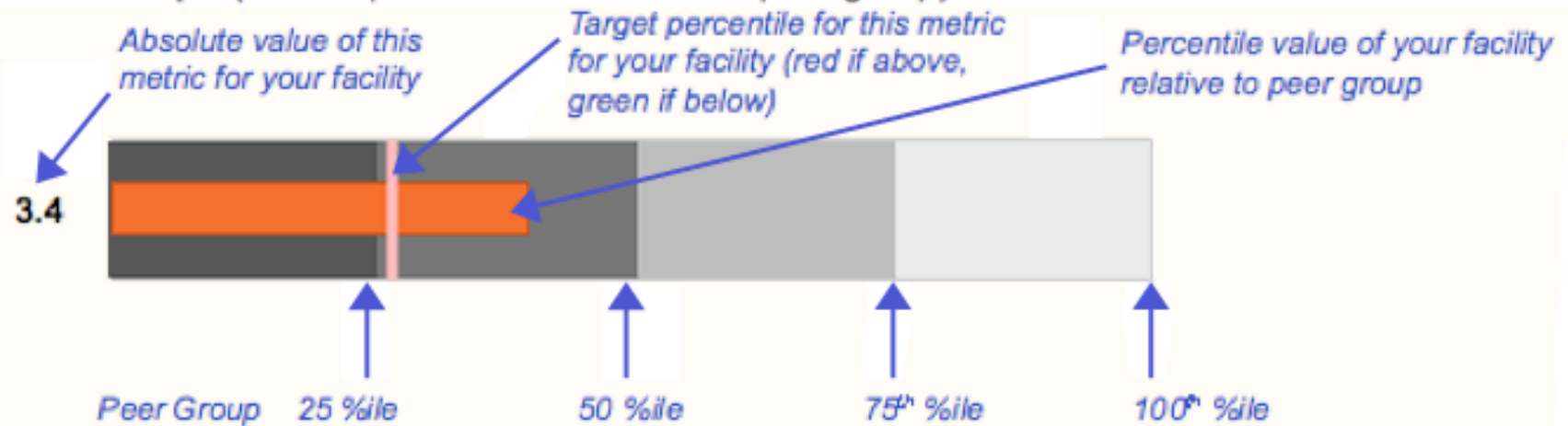
# Dashboard Tab



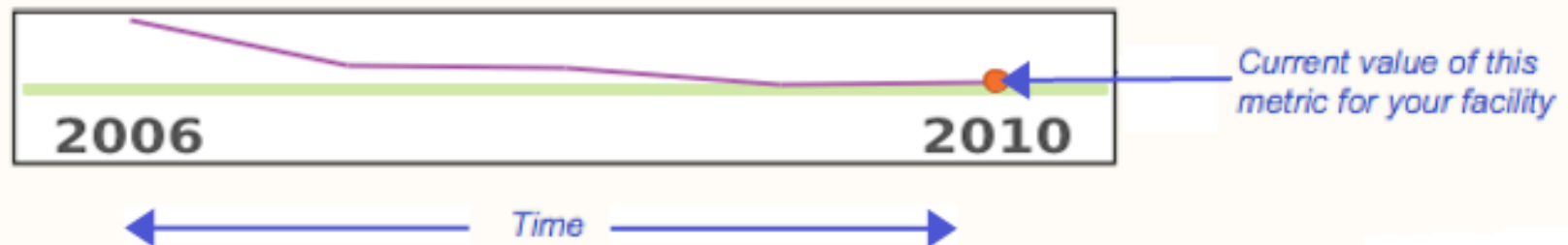
- ❑ Benchmark vs peers
- ❑ Progress towards targets (if specified)
- ❑ Progress over time

*A wide range of metrics can be displayed*

### Bullet Graph (current performance relative to peer group)

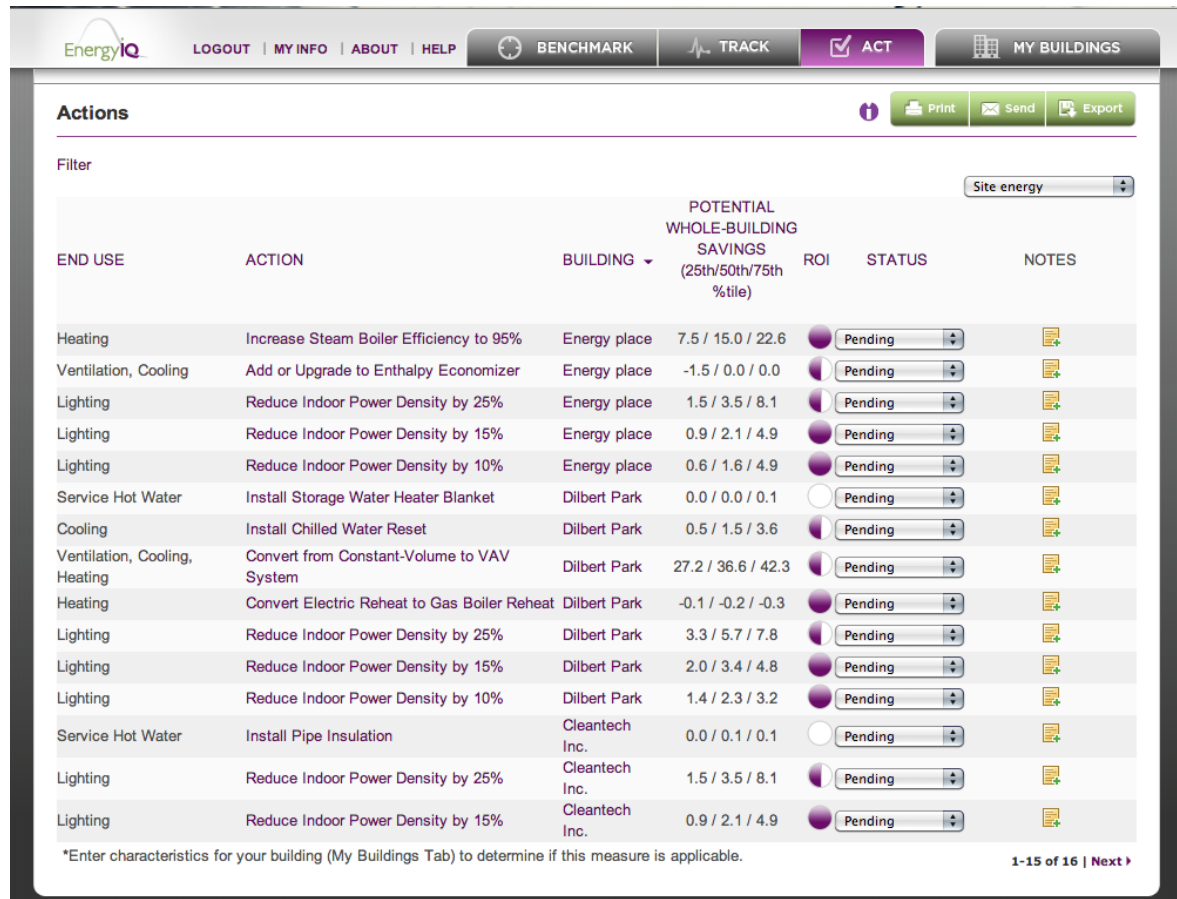


### Spark Line (historical trend)



# ACT Tab: Retrofit Options

- 65 potentially applicable energy upgrades for each user building => 65k bldg+measure combinations
- Ranges of savings shown, based on simulation results for all peer-group buildings (California buildings only)



The screenshot shows the EnergyIQ web application interface. At the top, there's a navigation bar with links for LOGOUT, MY INFO, ABOUT, HELP, BENCHMARK, TRACK, ACT (highlighted), and MY BUILDINGS. Below the navigation bar, there's a section titled "Actions" with a filter dropdown set to "Site energy". The main content is a table listing retrofit options for various buildings.

END USE	ACTION	BUILDING	POTENTIAL WHOLE-BUILDING SAVINGS (25th/50th/75th %tile)	ROI	STATUS	NOTES
Heating	Increase Steam Boiler Efficiency to 95%	Energy place	7.5 / 15.0 / 22.6		Pending	
Ventilation, Cooling	Add or Upgrade to Enthalpy Economizer	Energy place	-1.5 / 0.0 / 0.0		Pending	
Lighting	Reduce Indoor Power Density by 25%	Energy place	1.5 / 3.5 / 8.1		Pending	
Lighting	Reduce Indoor Power Density by 15%	Energy place	0.9 / 2.1 / 4.9		Pending	
Lighting	Reduce Indoor Power Density by 10%	Energy place	0.6 / 1.6 / 4.9		Pending	
Service Hot Water	Install Storage Water Heater Blanket	Dilbert Park	0.0 / 0.0 / 0.1		Pending	
Cooling	Install Chilled Water Reset	Dilbert Park	0.5 / 1.5 / 3.6		Pending	
Ventilation, Cooling, Heating	Convert from Constant-Volume to VAV System	Dilbert Park	27.2 / 36.6 / 42.3		Pending	
Heating	Convert Electric Reheat to Gas Boiler Reheat	Dilbert Park	-0.1 / -0.2 / -0.3		Pending	
Lighting	Reduce Indoor Power Density by 25%	Dilbert Park	3.3 / 5.7 / 7.8		Pending	
Lighting	Reduce Indoor Power Density by 15%	Dilbert Park	2.0 / 3.4 / 4.8		Pending	
Lighting	Reduce Indoor Power Density by 10%	Dilbert Park	1.4 / 2.3 / 3.2		Pending	
Service Hot Water	Install Pipe Insulation	Cleantech Inc.	0.0 / 0.1 / 0.1		Pending	
Lighting	Reduce Indoor Power Density by 25%	Cleantech Inc.	1.5 / 3.5 / 8.1		Pending	
Lighting	Reduce Indoor Power Density by 15%	Cleantech Inc.	0.9 / 2.1 / 4.9		Pending	

\*Enter characteristics for your building (My Buildings Tab) to determine if this measure is applicable.

1-15 of 16 | Next

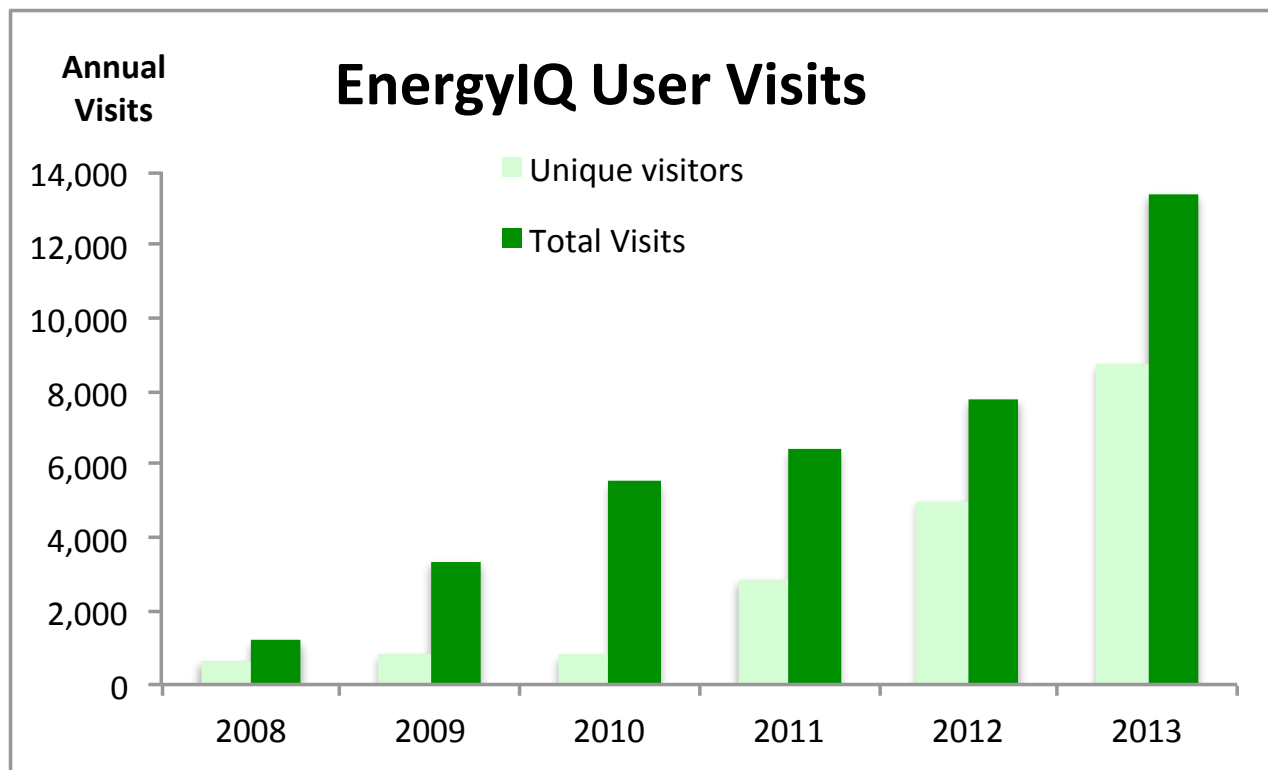


# Deployment & Technology Transfer



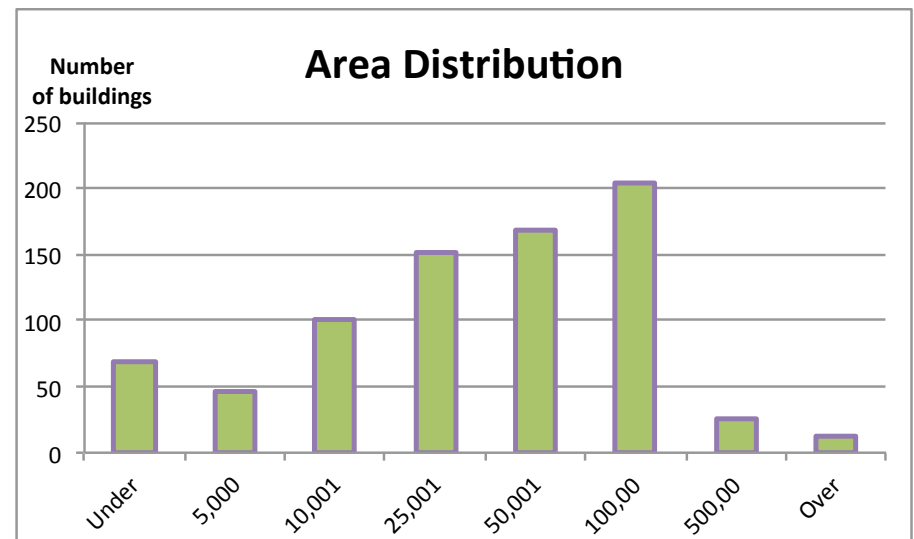
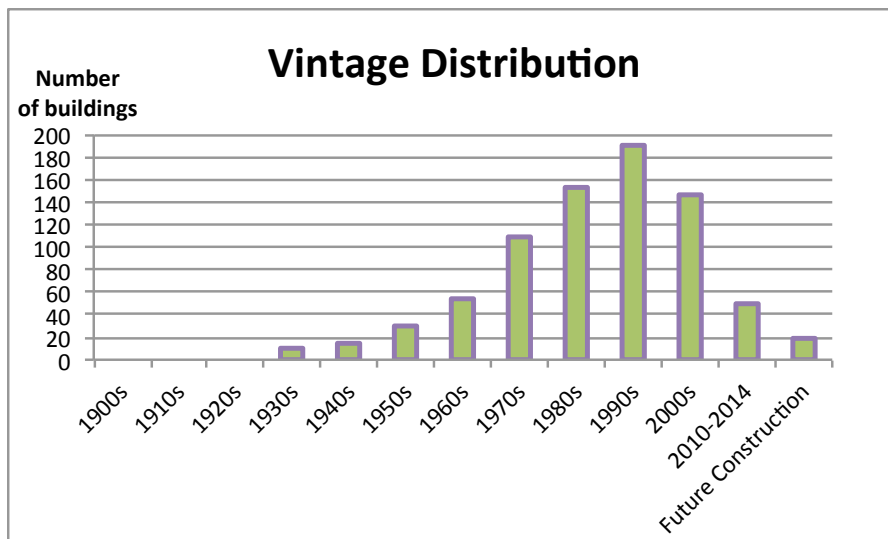
# Usage: Website

- Total visits: **43,300**
- Unique visitors: **20,000**
- Total page-views: **148,000**
- Countries: **134**



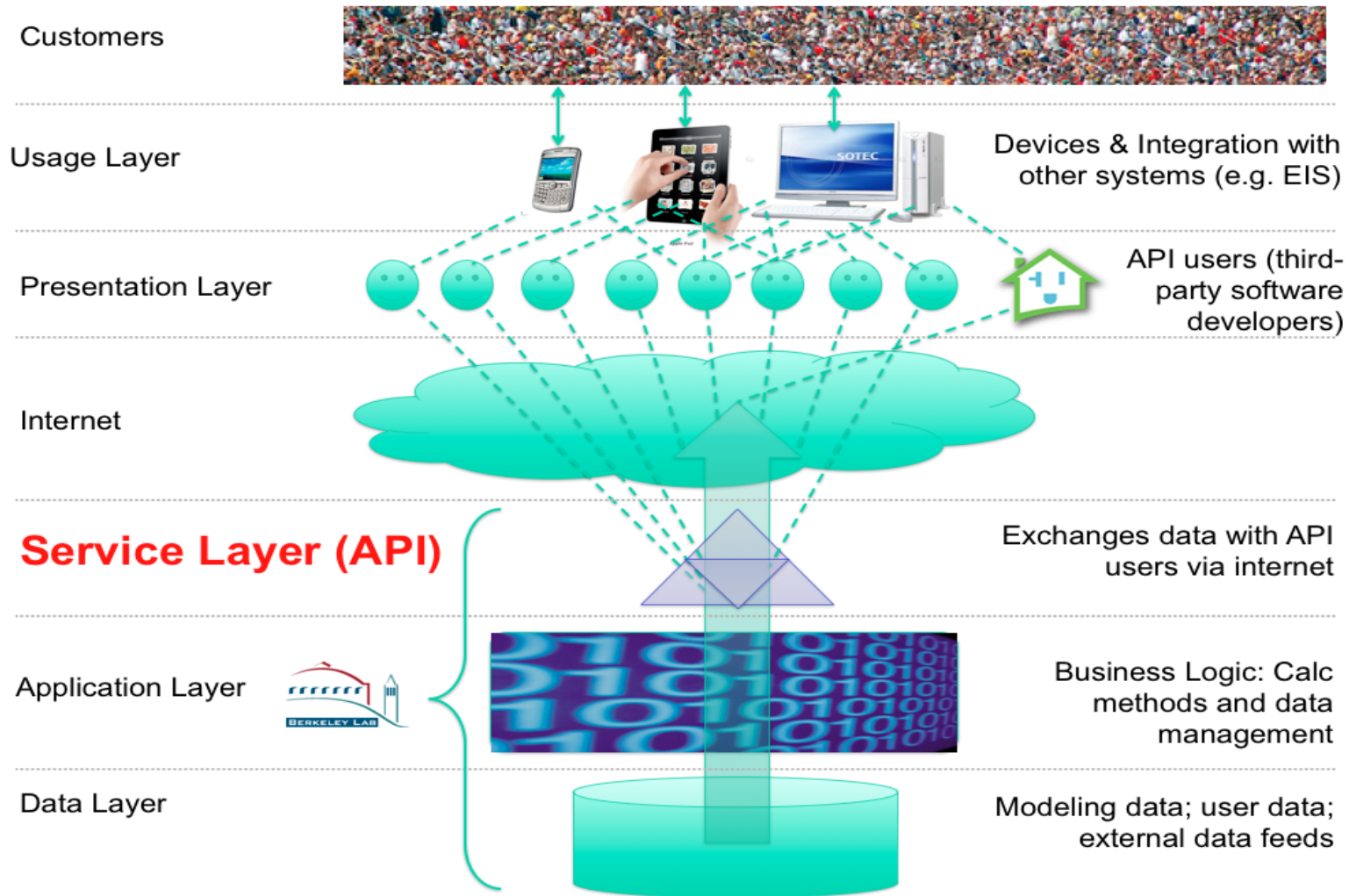
# Usage: Accounts & Bldgs (as of 4/2014)

- Number of registered users: **1,139**
- Number of user-entered buildings: **781**
- Total floor area of buildings entered: **106 million ft<sup>2</sup>**



# APIs...

APIs are protocols through which the a host computer and a client computer communicate and exchange data, leaving client free to decide how to gather input data from its customers and how to present them with results



# APIs

## Pros

- Speeds and simplifies syndication of models and databases
- Radically lowers the cost of entry for private software developers
- Developers can focus more on front-end
- Enables more rapid innovation and differentiation of tools
- Facilitates more internal consistency in methodology and data across proliferation of tools
- Ameliorates stereotypical separation between “public” and “private” tools

## Cons

- Requires web-infrastructure
- Derivative tools all depend on single API provider
- Initial development is slower; user support
- Developers need special skills and to be able to understand and adapt to outside service and support paradigm
- Requires very explicit documentation for third-party developers

# Usage: API Licensing


(New: available since June 2013)

- Signups: 32
- Inquiries: 43
- Licensees: 3



# API licensing & support site

<https://developers.buildingsapi.lbl.gov/>




## BERKELEY LAB

LAWRENCE BERKELEY NATIONAL LABORATORY

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[HOME](#) | [HOME ENERGY SAVER](#) | [SCORING TOOL](#) | [ENERGYIQ](#)

*This site provides everything website developers need to access our APIs for analyzing energy use in residential and commercial buildings. Read about how people are [using our APIs](#)*




### Home Energy Saver

The Home Energy Saver tool suite and APIs—the culmination of a decade and a half of development by the U.S. Department of Energy's [Lawrence Berkeley National Laboratory](#)—provides web-based residential energy calculators for [consumers](#) and [professionals](#). These tools provide customized estimates of residential energy use, energy bills, and greenhouse-gas emissions, based on information provided by the user. The service identifies and ranks potential energy-saving strategies for any single family detached or townhouse style home and multifamily apartment buildings.

[Release History](#)

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### Scoring Tool

The [Home Energy Scoring Tool](#) provides an "asset rating" of a home's energy use under standardized occupancy and operational conditions. Qualified assessors can gather the information needed to assess a home in one short site visit. The tool underpins the U.S. Department of Energy's new [Home Energy Score Program](#), designed to label homes across the country. With these APIs, approved software developers can generate home energy scores as a stand-alone service or as an add-on to a home inspection or comprehensive energy assessment.

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### EnergyIQ

The [EnergyIQ](#) action-oriented benchmarking system enables users to compare the energy performance of a non-residential building to a user-defined peer group, and generates an opportunity assessment with general recommendations on how to save energy and money, while reducing greenhouse-gas emissions.


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# Public-facing documentation

<https://sites.google.com/a/lbl.gov/energyiq/>



Search this site

Welcome !

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    [Track dashboard](#)  
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[EnergyIQ v Portfolio Manager](#)  
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▼ [Methodology](#)  
    [Benchmarking datasets](#)  
    [Filtering to define peer groups](#)  
    [Features benchmarking](#)  
    ▶ [ACT: Upgrade Analysis](#)

## Welcome !

EnergyIQ is an action-oriented benchmarking tool for non-residential buildings. Visit us at <http://EnergyIQ.lbl.gov>.

Energy managers, building owners, and energy analysts use it to:

- Compare your existing or proposed building to others in the same peer group
- Identify retrofit strategies to optimize energy use
- Save money
- Reduce carbon emissions

This wiki leads off with a User Guide to help you quickly access the functions of the website. The subsequent set of links provide technical documentation for those interested in our methodology and the underlying data.

## Comments

You do not have permission to add comments.



# Infrastructure

- Code: The EnergyIQ APIs are written in PHP, with pervasive use of JavaScript and CSS2. EnergyIQ also supports a SOAP-based web service to allow the flow of queries and data to occur with non-browser implementations.
- Database: Oracle 10g
- Hosting: Amazon cloud



# Pubs

- Mills, E. 2014. "Action-Oriented Benchmarking with EnergyIQ." *IEEE Proceedings* (in preparation)
- Mills, E., P. Mathew, N. Bourassa, M. Brook, and M.A. Piette. 2008. "Action-Oriented Benchmarking: Concepts and Tools." *Energy Engineering*, 105(4):21-40. LBNL-358E
- Mathew, P., E. Mills, N. Bourassa, M. Brook. 2008. "Action-Oriented Benchmarking: Using the CEUS Database to Benchmark Commercial Buildings in California." *Energy Engineering*, 105(5):6-18. LBNL-502E
- Mills, E. and P. Mathew. 2012. "Web Services that Foster Innovation in Buildings Energy Analysis Tools," 2012. *Proceedings of the 2012 ACEEE Summer Study on Energy Efficiency in Buildings*, American Council for an Energy-Efficient Economy: Washington, D.C.
- Mills, E. and P. Mathew. 2014. "Monitoring-Based Commissioning: Benchmarking Analysis of 24 University Buildings in California," *Energy Engineering* 111(4):7-24

